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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:	James C. Anderson, et al.	Examiner: Jason C. Olson
Serial No.:	10/719,515	Group Art Unit: 2627
Filed:	November 20, 2003	Docket No.: 200309574-1
Title:	Method and Apparatus for Storing Data on Magnetic Tape	

DECLARATION UNDER 37 CFR § 1.131

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

We, James C. Anderson, Martin J. Harper, Vernon L. Knowles, and Donald J. Fasen, declare as follows:

1. We are the named co-inventors in the above-captioned patent application and of the subject matter described and claimed therein.

2. The invention in the above-captioned patent application was conceived by James C. Anderson, Martin J. Harper, Vernon L. Knowles, and Donald J. Fasen, collaborating as co-inventors.

3. The invention described and claimed in the above-captioned US patent application was actually reduced to practice in the United States by James C. Anderson, Martin J. Harper, Vernon L. Knowles, and Donald J. Fasen prior to September 12, 2003, the effective date of USPN 2005/0057843 (Egan).

4. Exhibit 1, attached hereto, is a redacted copy of the invention disclosure for above-captioned US patent application. The invention disclosure was signed by James C. Anderson, Martin J. Harper, Vernon L. Knowles, and Donald J. Fasen in January 2003 prior to September 12, 2003, the effective date of USPN 2005/0057843 (Egan).

5. Exhibit 1, attached hereto, also includes a report entitled "Investigating the Benefits of an Accelerometer in Gen3." This report was attached to the original invention disclosure and shows that the invention and claimed subject matter were actually reduced to practice in the United States prior to September 12, 2003, the effective date of USPN 2005/0057843 (Egan). Accordingly, Exhibit 1 shows that the structure described and claimed in the above-captioned patent application was reduced to practice prior to the effective date of September 12, 2003 of Egan.

We declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful, false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful, false statements may jeopardize the validity of the application or an patent issuing thereon.

James C Anderson Dated: June 27, 2006
James C. Anderson

Martin J Harper Dated: June 27, 2006
Martin J. Harper

Vernon L Knowles Dated: June 27, 2006
Vernon L. Knowles

Donald J. Fasen Dated: June 29, 2006
Donald J. Fasen

TAPE.US

HEWLETT PACKARD **INVENTION DISCLOSURE** PAGE ONE OF 7

PDNO 200309574 DATE RCVD 1.31.03 ATTORNEY

*Instructions: The information contained in this document is **COMPANY CONFIDENTIAL** and may not be disclosed to others without prior authorization. Submit this disclosure to the HP Legal Department as soon as possible. No patent protection is possible until a patent application is authorized, prepared, and submitted to the Government.*

Descriptive Title of Invention:
Tape drive Head Positioning Servo System With Accelerometer Input for Improved Shock and Vibration Performance

Name of Project: Ultrium Linear Tape Drive

Product Name or Number:

Was a description of the invention published, or are you planning to publish? If so, the date(s) and publication(s):
No

Was a product including the invention announced, offered for sale, sold, or is such activity proposed? If so, the date(s) and location(s):
No

Was the invention disclosed to anyone outside of HP, or will such disclosure occur? If so, the date(s) and name(s):
Yes. Jabil Vienna. They do the mechanism design and manufacturing.

If any of the above situations will occur within 3 months, call your IP attorney or the Legal Department now at: 1-857-2542 or 415-857-2542

Was the invention described in a lab book or other record? If so, please identify (lab book #, etc.)
Yes. http://qb2 www.boi.hp.com/ndon/hdpos/shock_vib/shock_vib.htm/

Was the invention built or tested? If so, the date:
Yes, ~~20 Nov 02~~ 3/23/2000

Was this invention made under a government contract? If so, the agency and contract number:
No

Description of Invention: *Please preserve all records of the invention and attach additional pages for the following. Each additional page should be signed and dated by the inventor(s) and witness(es).*

A. Prior solutions and their disadvantages (if available, attach copies of product literature, technical articles, patents, etc.).
B. Problems solved by the invention.
C. Advantages of the invention over what has been done before.
D. Description of the construction and operation of the invention (include appropriate schematic, block, & timing diagrams; drawings; samples; graphs; flowcharts; computer listings; test results; etc.)

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Signature of Inventor(s): Pursuant to my (our) employment agreement, I (we) submit this disclosure on this date: 21 Jan 03

91965	James C. Anderson		396-4225	477	CPB R&D
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434867	Martin J. Harper		396-2785	477	CPB R&D
Employee No.	Name	Signature	Telnet	Mailstop	Entity & Lab Name
48352	Vernon L. Knowles		396-3452	477	CPB R&D
Employee No	Name	Signature	Telnet	Mailstop	Entity & Lab Name
348128	Donald J. Fasen		396-3299	400	PSB R+D
Employee No.	Name	Signature	Telnet	Mailstop	Entity & Lab Name

(If more than four inventors, include additional information on another copy of this form and attach to this document)

Form 3.1 IDFDOC.DOC Rev. 6/26/97

HEWLETT-PACKARD **INVENTION DISCLOSURE** COMPANY CONFIDENTIAL PAGE 2 OF 7

Signature of Witness(es): *(Please try to obtain the signature of the person(s) to whom invention was first disclosed.)*
The invention was first explained to, and understood by, me (us) on this date: [Jun 73 03]

Full Name	Signature	Date of Signature
TED A. BROOKS	Ted Brooks	1/24/2003
[illegible]	[illegible]	[illegible]

Inventor & Home Address Information: *(If more than four inventors, include addl. information on a copy of this form & attach to this document)*

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Tape Drive Head Positioning Servo System With Accelerometer Input for Improved Shock & Vibration Performance

Tape drives will continue to evolve and store more user data on each cartridge. This will require increased track and linear bit densities. As the track spacing gets narrower it becomes more difficult to position the read/write heads over the data tracks within the accuracy required especially with external shock and vibration shaking the product. This invention describes using an accelerometer mounted in the tape drive to measure the external disturbance and feed that signal into the head positioning servo system. This signal can be used to control electrical current into the head positioning voice coil motor to move the head and follow the effects of external vibration. With this invention, the error in positioning the head to the tape track center due to external vibration can be virtually eliminated. (See the attached report by Martin Harper)

To get the best feedback from the accelerometer it should be located as close to the read/write head as possible since it is the magnitude of the external disturbance at the head that needs to be compensated for. It also must measure acceleration in the same axis as the head positioning actuator moves since this is the direction the head becomes off of tape track center. Since all of the HP Ultrium products use a common head positioning actuator it is desirable to build the accelerometer into the actuator so that it can easily be added to all drive platforms and be in close proximity of the head. One way to accomplish this is to place the accelerometer and accompanying electronics on the variable inductance (VI) pca, which is located on the actuator.

For the accelerometer enhanced servo system to work properly the tape drive should have an isolation mounting system to remove the higher frequency components of vibration from reaching the chassis. Typically the resonant frequency of the chassis on the isolation mounts is 50 to 200 Hz. This isolation mounting system usually consists of rubber grommets that isolate the drive chassis from the mounting points. Don Fasen did testing several years ago on an accelerometer enhanced servo system on the Einstein drive that did not have isolation mounts. This system did not work well because external vibrations in 300 to 500 Hz frequency range excited bending modes of the chassis. Because of these bending modes the accelerometer did not accurately measure the difference in acceleration between the head and the tape.

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Witnesses: [illegible] 1/24/03
[illegible]

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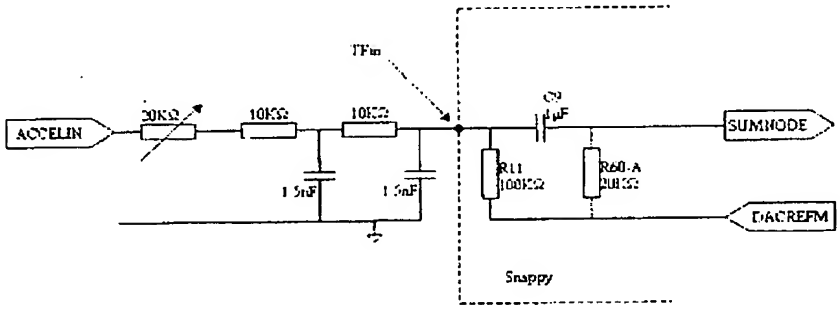
Investigating the Benefit of an Accelerometer in Gen3

Report by: Martin Harper

Last Updated: [redacted]

Executive Summary
Using a laboratory grade accelerometer with hand built additional circuitry and manual calibration, a Faraday drive with the Faraday MR compensator design passed with margin the roadmap Gen 4 track pitch (1024 tracks) offtrack limit specification whilst being subjected to 0.3g 5 - 500Hz random vibration.

These are the results of the initial investigation into the potential benefits (if any) of using an accelerometer as part of the head position servo tracking control loop. The set up consisted of a laboratory accelerometer and charge amp with output from the charge amp scaled to 1V per G. The output was fed through a potentiometer for signal level matching then into a low pass filter with a cutoff of 10KHz as there were some issues with a pure tone appearing from the accelerometer at around 36KHz. The output of the filter was then fed directly into TFin on the snappy allowing the use of the built in coupling capacitor and input resistance to the summing node in the servo loop. These form a high pass filter stage with a cutin of around 10Hz. A representation of the circuit is shown below.



In all these tests, Faraday drive #F33001312 was used in normal orientation unless otherwise stated. The Random vibration 5 - 500Hz transfer function measurements were taken at various levels noted with the results. The method of calibration was to determine the resonant frequency of the shock mounts from the random transfer function without the accelerometer, around 160Hz. The table was then set to dwell at this frequency so PES could be monitored as the accelerometer feedback was fed into the loop. The feedback signal level was adjusted using the potentiometer until the sine wave present in PES was at a minimum. When set, a repeat measurements of random vibration, 5 - 500Hz at various levels were done to determine the effect. PesScans were also done to note any change in the number of events and PES sigma values. All the results are shown below;

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Witnesses: [illegible] 1/24/03
[illegible]

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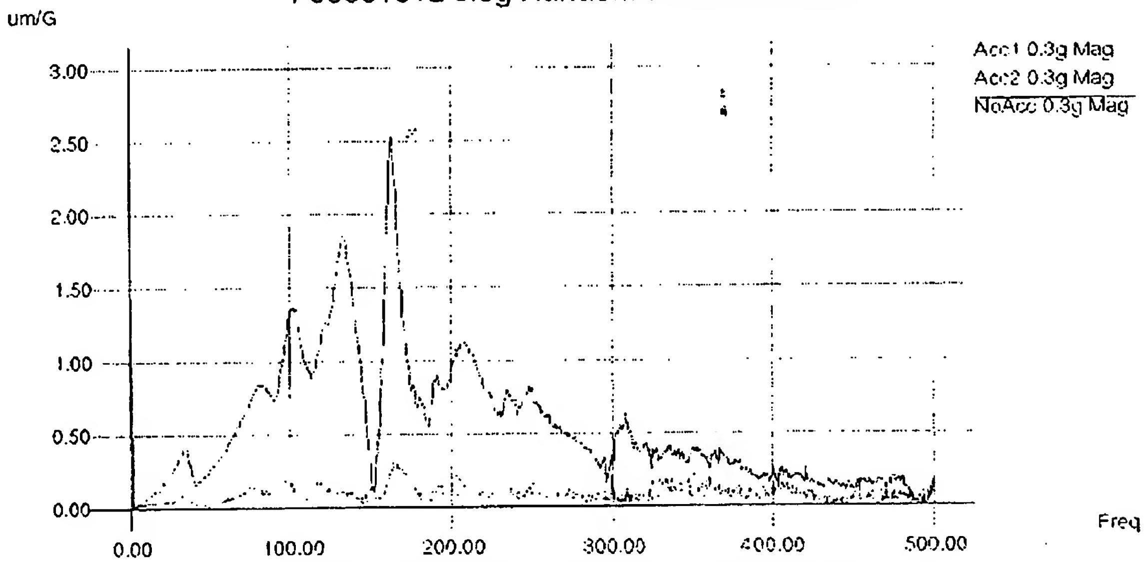
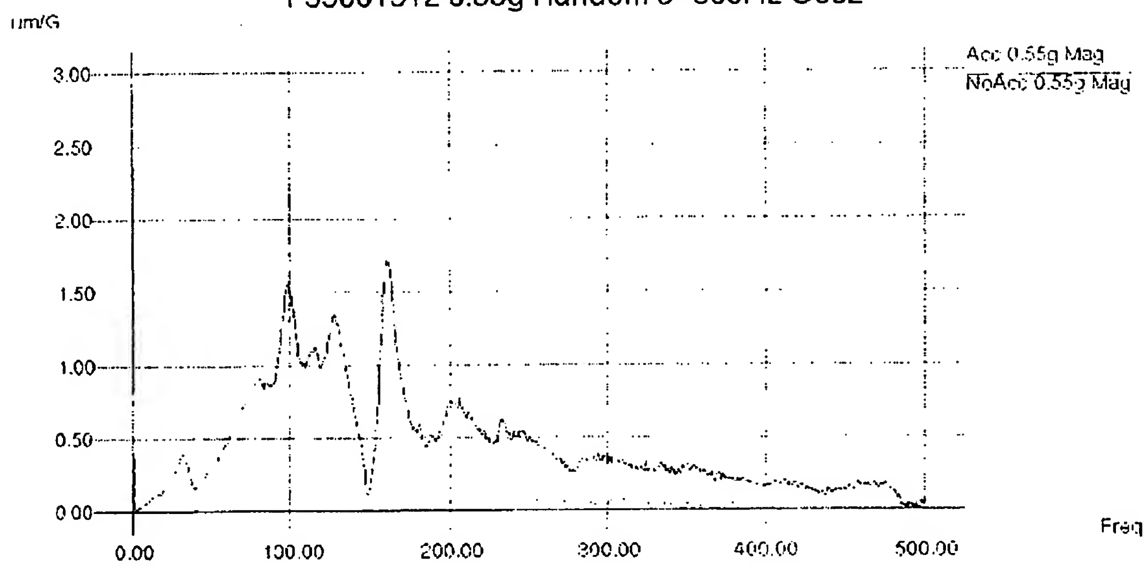
F33001312 0.3g Random 5-500Hz C062



F33001312 0.55g Random 5-500Hz C062



Inventors: James C Anderson 1/21/03
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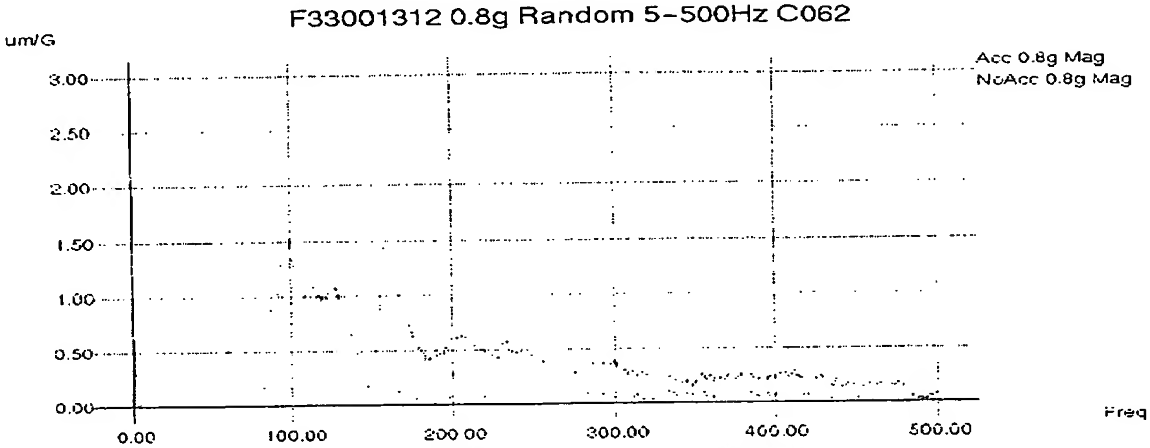
Witnesses:
[illegible] 1/21/03
[illegible]



Direction	Level	>3um	>2um	>1.7um	>1.3um	Sigma(um)	Accelerometer
FWD	0.3g	0	0			0.2900	No
REV	0.3g	0	0			0.3166	No
FWD	0.3g	0	0			0.2207	Yes
REV	0.3g	0	0			0.2593	Yes
FWD	0.55g	0	0			0.3985	No
REV	0.55g	0	24			0.4300	No
FWD	0.55g	0	0			0.2269	Yes
REV	0.55g	1	6			0.2720	Yes
FWD	0.8g	0	111			0.5222	No
REV	0.8g	22	294			0.5560	No
FWD	0.8g	0	0			0.2420	Yes
REV	0.8g	12	52			0.2970	Yes
FWD	0.3g			0	8	0.2890	No
REV	0.3g			4	138	0.3212	No
FWD	0.3g			0	2	0.2195	Yes
REV	0.3g			0	32	0.2577	Yes
FWD	0.8g			490	3020	0.5257	No
REV	0.8g			976	4441	0.5581	No
FWD	0.8g			0	10	0.2423	Yes
REV	0.8g			114	314	0.3001	Yes

Next I looked at Tape Path Down orientation and was a little surprised at what I saw. I was expecting the table to PES transfer function to look a little different now the vibration was acting against the guide rails on the actuator. It's true to say they are different but there are still significant in plane disturbances measured by the accelerometer. The good news seems to be that the accelerometer as used made an equally good job of cancelling these effects. Both forward and reverse transfer functions were taken from table to PES:

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Witnesses: [illegible] 1/24/03
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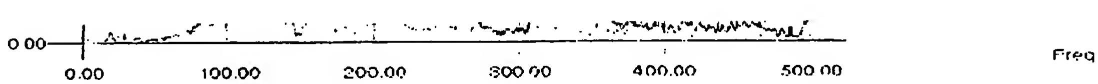

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Computer Peripherals Bristol

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